



Poultry Physiology: Adaptation to the Environment

AgScience Poultry Science Curriculum
Section 4

Introduction

What is health?

General condition or state

Absence of disease

Physiological processes must be maintained for health

What are some physiological processes that must be maintained for health?

Heart rate (beats/min)

- Chicken – 250-300

- Turkey – 160-175

Respiration Rate (breaths/min)

- Chicken – 12-36

- Turkey – 28-49

Body Temperature

- Chicken – 101-103°F

- Turkey – 105-109°F

Important to understand the impact of the animals environment on physiological processes to make sound information-based management decisions¹

Introduction

Poultry are **homeothermic animals**, or warm blooded mammals

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Homeothermic animals must maintain a nearly constant inner body temperature.

Homeostasis is the maintenance of a constant body temperature

- Heat output=heat input

Animals produce heat through normal body processes such as metabolism

- Use heat to stay warm if environmental temperature is cold
- Dissipate this heat if environmental temperature is too warm

Mechanisms of Heat Loss

Because maintenance of homeostasis is critical homoeothermic animals must have a way to dissipate excess heat

Two forms of heat loss:

- **Sensible**
- **Insensible**

Three forms of sensible heat loss:

- **Conduction** - Heat exchange between two objects that are in contact that differ in temperature.
- **Convection** – Heat movement by streams of particles
- **Radiation** – Flow of heat without the aid of a material medium

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Mechanisms of Heat Loss

Insensible heat loss:

Heat loss that does not increase the temperature of the surrounding air

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Thermoregulation

Series of processes to maintain body temperature:

Active thermoregulation:

- Increased heart rate
- Panting
- Sweating (Not in birds)

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Passive thermoregulation:

- Vasoconstriction
- Vasodilatation
- Behavioral changes

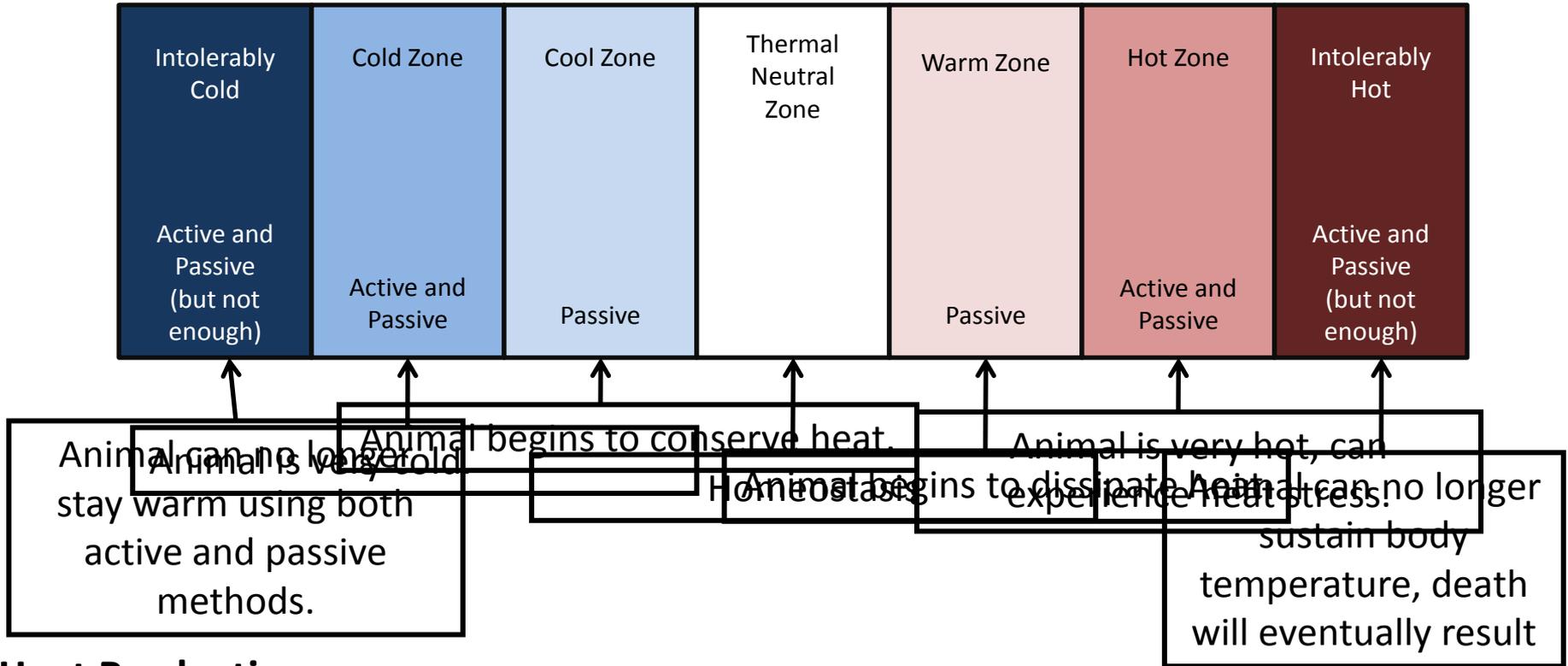
Vasoconstriction – narrowing of the blood vessels, used to conserve body heat



Vasodilatation – widening of the blood vessels, used to dissipate body heat



Temperature Regulation



Heat Production:

Smaller birds produce less total heat

More produced/unit body weight

Big birds produce more heat

Less produced/unit body weight

Environmental effects on physiology

Commercial poultry grown in contained environment

Protect from extreme environmental changes

Temperature, relative humidity, wind speed

Temperature –

- **At 70°F, 75% of heat loss in sensible**
- **Greater than 85°F amount of insensible heat loss increases**

Humidity –

- **Affects insensible heat loss**
- **Amount of water that can be absorbed by air decreases as humidity increases**

Environmental effects on physiology

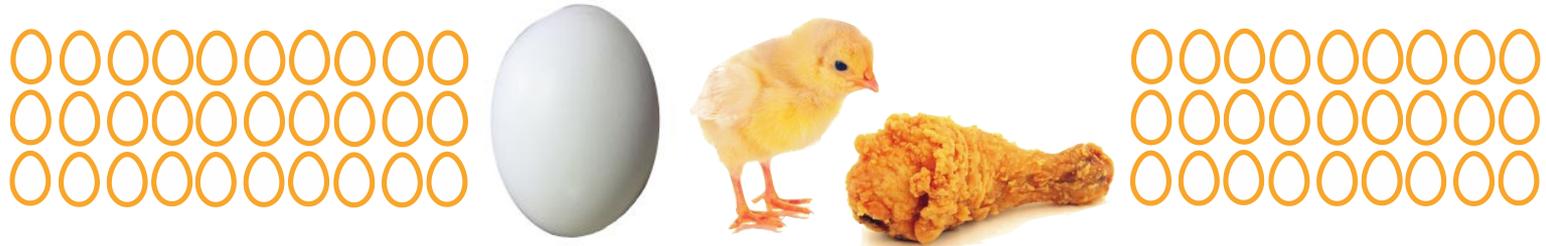
Ambient temperature effects feed and water intake

As temperature increases:

- **Water intake increases as moisture loss through insensible heat loss increases.**
- **Feed intake decreases as environmental temperature increases**

The heat produced through consumption and metabolism of feed is called **heat increment.**

Heat increment is detrimental to birds particularly in Hot and Intolerably Hot zone.



Poultry Health

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Disease Prevention

“An ounce of prevention is worth a pound of cure”

- Proper nutrition
- Sanitation
- Biosecurity
- Vaccination

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“**Biosecurity** is the first line of defense on farm for protecting animals from disease”¹

Why Biosecurity?

Minimize risk of disease transmission from outside sources

Reduce transmission between groups on same farm

Disease Prevention - Biosecurity

Common Biosecurity Practices:

- Poultry houses should be kept locked
- Separate clothes for working on-farm (can include showering prior to entering facility)
- 3 days clean – Allowing 3 day window between visiting different flocks
- Control visitor traffic
- Visitors should wear protective clothing
 - Plastic boots, hair nets etc.
- Before entering facility scrub vehicles undercarriage and tires with disinfectant
- Clean and disinfect all equipment prior to use
- Dispose of mortality properly
- Avoid contact with wild game

Health and Disease

Remember: Definition of Health

Disease – Any other state than complete health

Symptom vs. Clinical sign

Animals – clinical sign

Clinical signs include:

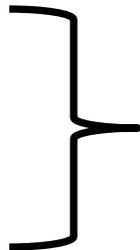
Fever, weight loss, reduced performance

Lesion – Change in body organ

Size

Color

Shape



Tumor or abscess

Being able to recognize clinical signs is critical for any farmer!

Health and Disease

Predisposing Cause–

Stress, poor conformation, malnutrition

Direct Cause –

Pathogen – Disease causing agent

Bacteria

Virus

Parasite

Protozoa

Fungi

Infectious disease – can be communicated from one animal to another

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Disease Causing Agents

Bacteria

Single-celled organisms

Ubiquitous

Some cause disease if appropriate infectious dose

Example: Salmonella, Cholera, etc.

Infectious dose –
amount of pathogen
required to cause
infection in host

Virus

Non-living organism, DNA/RNA in protein coat

Only reproduce in host organism

Example: Marek's Disease, Infectious Bronchitis, etc

Disease Causing Agents

Parasite

Organism that lives on or in host organism and get food from the host

Ex. Fowl mite

Protozoa

Single-celled organisms

Parasitic or free-living

Ex. Coccidiosis

Fungi

Multi-cellular eukaryotic organisms

Some cause disease, typically if ingested in old feed ingredients

Ex. Mycotoxicosis

Lifecycle of Infectious Disease

1. Pathogen must gain entrance to body
2. Assimilation and multiplication in host
3. Exit host
4. Infect another host

Which of pathogens previously mentioned would be considered infectious?

Bacteria and Virus

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Infectious Disease Transmission

Recognize potential disease carriers is key to maintaining a healthy flock

Some common methods of infectious disease transmission:

Introducing/coming into contact with other diseased birds

Introducing/coming into contact with healthy birds that could be carriers of disease

Bringing contaminated equipment on-farm

Shoes and clothing of visitors

Unclean water

Rodents and wild birds

Contaminated delivery trucks (live haul trucks, feed trucks, etc)

Health and Disease

Pathogenicity – Ability of an organism to cause disease

Virulence – Degree of pathogenicity

Less pathogenic (less virulent) organisms will only cause disease in compromised host

More pathogenic (more virulent) organisms will cause disease in healthy animals

Clinical Disease – Clinical signs are evident

Subclinical disease – Clinical signs are not readily evident/observable; Animals with subclinical disease will often be carriers

Acute Disease – Often characterized by sudden onset of symptoms, termination of disease either recovery or death (2-3 weeks)

Chronic Disease – Develop slowly over period of weeks, often reduced performance noted instead of clinical signs

Health and Disease - Immunity

Immunity is a state of resistance in the animal to a disease-producing agent.

Two general categories of acquired immunity:

Active and Passive

Passive Immunity – Maternal immunity (Colostrum in mammals); introduction of antibodies

Active Immunity – Natural exposure and recovery; production of antibodies against specific antigens; vaccines, also known as acquired immunity

Humoral Immunity – Immune cells that fight infection, macrophages and heterophils

Antibodies – Proteins produced by the body that label cells of infectious agents for destruction by macrophages and heterophils

Vaccination

Commonly done in hatchery

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In-ovo vaccine

Technology developed for vaccinating chicks while still in egg

Spray vaccine

Some flocks may need to be vaccinated on-farm

Laying flocks

Other vaccine administration methods:

Drinking water

intraocular

Intranasal

Wing web

Sub Q